DIRECTIONS

for Installing and Operating

COPES

Boiler Feed Water Regulators

Continuous Flow

Stabilized Water Level

BOOK No. 26

NORTHERN EQUIPMENT COMPANY

ERIE, PA., U. S. A.

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CAUTION!

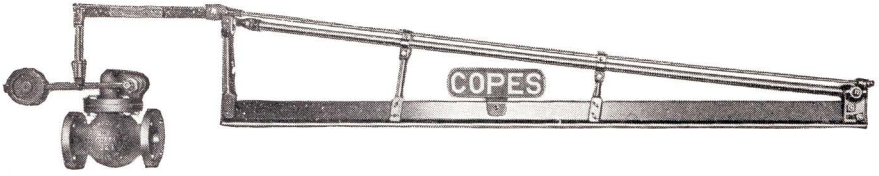
See that these directions reach the person who is responsible for the erection of the regulator

Read this booklet from cover to cover before you start the installation

THESE instructions cover the continuous feed stabilized water level type of COPES Regulator. This method of control is explained on page 10. COPES Regulators are made in a number of types and styles— to meet any practical conditions that may be found. Since COPES Regulators are built for the conditions under which the boilers are to operate *do not attempt to use these Regulators for any boilers except those for which they were ordered.*

The Regulators are extremely simple *but in order to secure the best results, these instructions should be followed very carefully.* Forget for the present, how COPES Regulators were installed on another job. Important improvements may have been made since that time. If you believe that certain instructions should be changed, or if you wish to suggest improvements in installation or in the regulator design or construction, the engineers at the factory will be glad to go into these matters with you. Feel free to consult with them. They have specialized on feed water regulation, have made many tests, and have done much experimental work to constantly improve COPES Regulators. They will therefore be glad to have your suggestions.

COPES Regulators enable boiler room employees to secure more efficient operation of the boilers. The regulators can be depended upon to do the mechanical job of feeding in the most efficient way, but they cannot supervise. That is a man's job.



Preserve These Instructions for Future Reference

A copy is sent with every shipment of regulators together with a copy of Installation Plans and a copy of Operating Instructions. Additional copies can be had at any time upon application to the Northern Equipment Co., Erie, Pa.

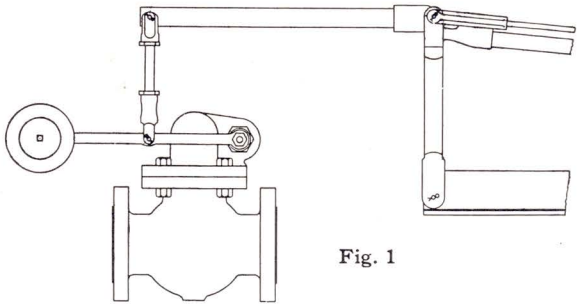


Fig. 1

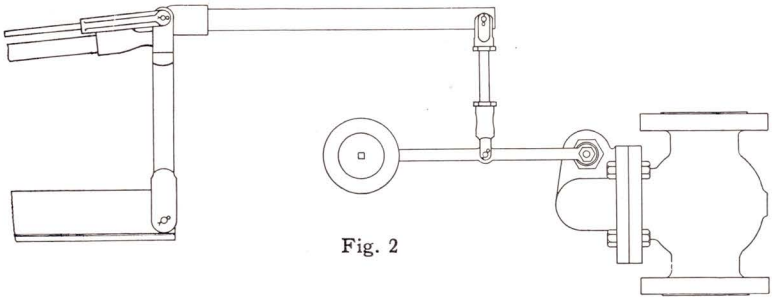


Fig. 2

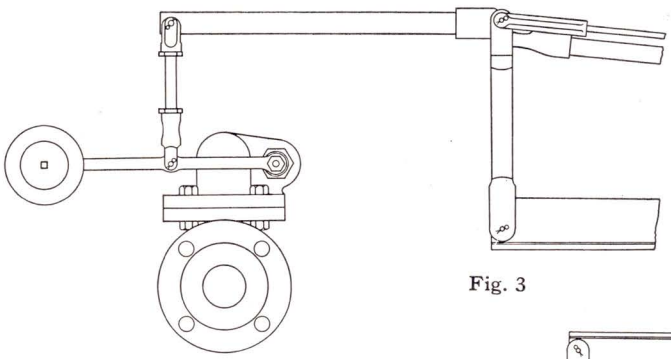


Fig. 3

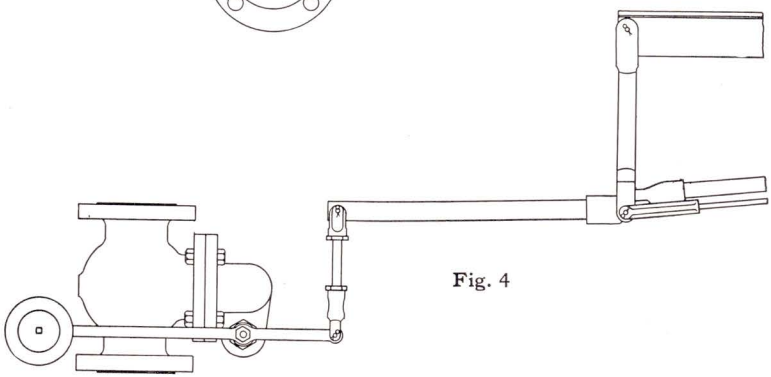


Fig. 4

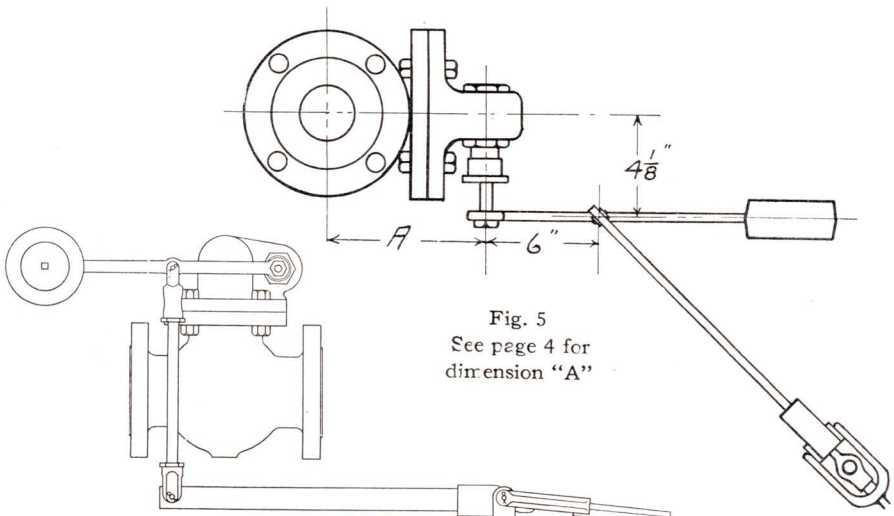


Fig. 5
See page 4 for
dimension "A"

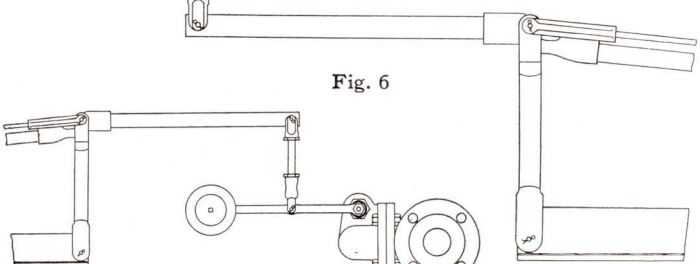


Fig. 6

Fig. 7

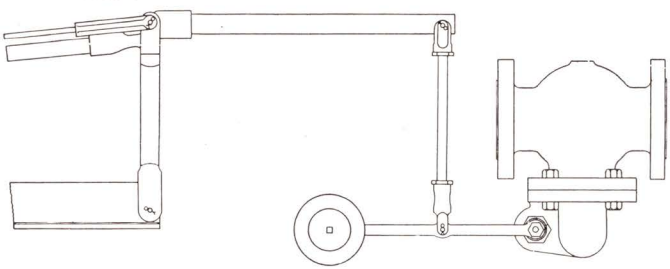


Fig. 8

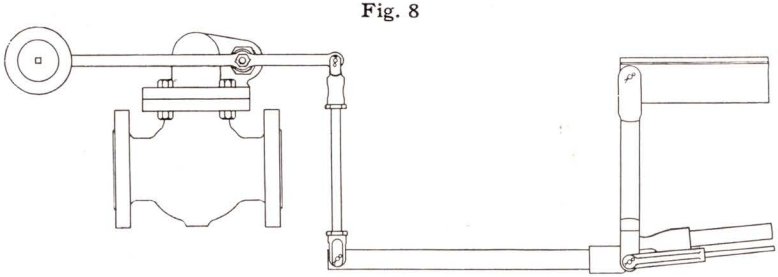


Fig. 9

Location of Regulator— The control valve, Fig. 10, should be placed in the feed line so that the strut (see Fig. 27) connecting the valve lever and the thermostat lever will be perfectly vertical.

The thermostat should be set with the center of the tube 1 inch below the normal water level.

It should also be located so that the *steam connection will be as short as possible.*

With these points in mind, make a survey of the boiler and feed line layout to determine the best location for the regulator. The cuts in this booklet will give ideas as to possible locations.

The Thermostat may be installed on the side, the front, or the back of the boiler— in the alleyway or on the wall.

See Figs. 1 to 9 inclusive, for various positions of the control valve.

By removing the Through Bolts, the Valve Bonnet may be placed in any desired position.

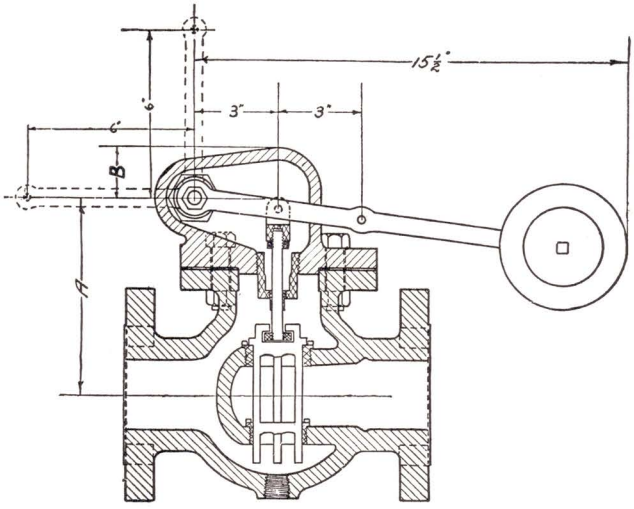


Fig. 10—COPES Control Valve

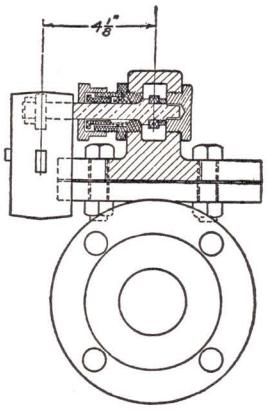


Fig. 11

FLANGED—ANGLE OR STRAIGHTWAY

Size of Valve–Inches	1	1¼	1½	2	2½	3	3½	4	5	6
Face to Face	7½	7½	9¼	10	10¾	12	12	13	16	17
Center to Face	3¾	3¾	4⅝	5	5⅜	6	6	6½	8	8½
Flange Diameter	4½	5	6	6½	7½	8¼	9	10	11	12½
Flange Thickness	11/16	¾	13/16	⅞	1	1⅛	1 3/16	1¼	1⅜	1 7/16
Bolt Circle Diameter	3¼	3¾	4½	5	5⅞	6⅝	7¼	7⅞	9¼	10⅝
No. of Bolts	4	4	4	4	4	8	8	8	8	12
Diameter of Bolts	½	½	⅝	⅝	¾	¾	¾	¾	¾	¾
Size of Bolt Holes	⅝	⅝	¾	¾	⅞	⅞	⅞	⅞	⅞	⅞
Raised Face Diameter	2 9/16	3 1/16	3 11/16	4 3/16	4 15/16	5 11/16	6 5/16	6 15/16	8 5/16	9 11/16
Approx. Wt. as shown	38	40	46	68	85	102	114	135	265	375
Dimension "A"	6 7/16	6 7/16	6½	6⅝	6 15/16	7½	7½	7¾	11¾	12½
Dimension "B"	1 13/16	1 13/16	1 13/16	1 13/16	1 13/16	1 13/16	1 13/16	1 13/16	2 3/16	2 3/16

SCREWED—ANGLE OR STRAIGHTWAY

Size of Valve—Inches	¾	1	1¼	1½	2	2½	3	3½
Face to Face	5⅜	6 7/16	6 7/16	7	7⅞	8⅜	9⅜	9⅜
Center to Face	2 11/16	3 7/32	3 7/32	3½	3 13/16	4 3/16	4 11/16	4 11/16
Approx. Wt. as shown	31	33	33	38	58	60	74	82

Data on larger sizes on application.

Installation of Control Valve

Fasten the lever securely to the ocillating shaft of the valve. *This is purposely made a tight fit* and should be forced on the square portion with the nut. *A file should not be used on these parts.*

In all cases be sure that the *downward movement of the weight closes the valve.*

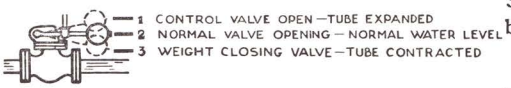


Fig. 12

While it is preferable to have the flow through the valve in the direction indicated by the arrow, that is not essential.

A ¾ inch blow-off plug is provided in the bowl of the valve. If the feed water contains any solid matter, insert a nipple and blow-off so that the valve can be blown out as frequently as conditions may require. Angle valves have no blow-off.

COPES control valves are furnished in straight-way, angle or three-way patterns, and with screwed or flanged ends. Every cast iron COPES control valve is guaranteed for a maximum working pressure of 350 lbs.; cast steel valves for 800 lbs.; brass valves for 500 lbs.

It is not necessary to place a by-pass around the COPES control valve. The regulator can be cut out of service by blocking the valve wide open.

That part of the feed line containing the control valve should be kept free from movement or excessive vibration in order that all of the expansive force of the thermostat will be used to open and close the valve.

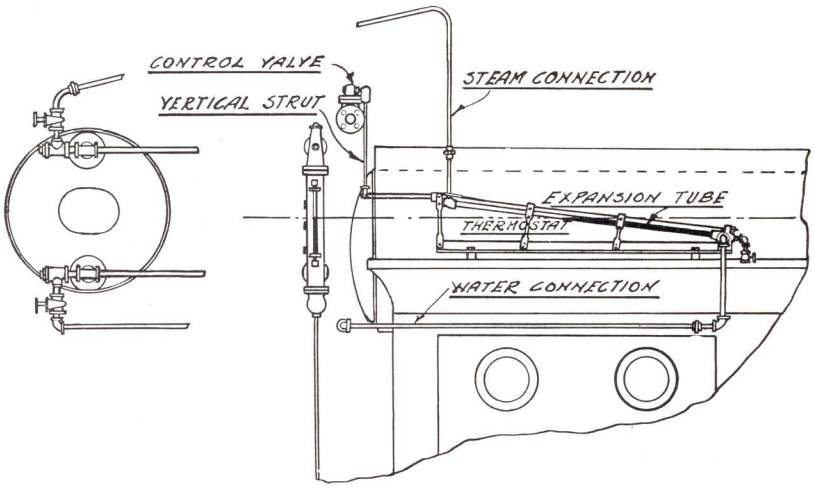


Fig. 13— One method of installing COPES Regulators on the Front of Stirling Boilers

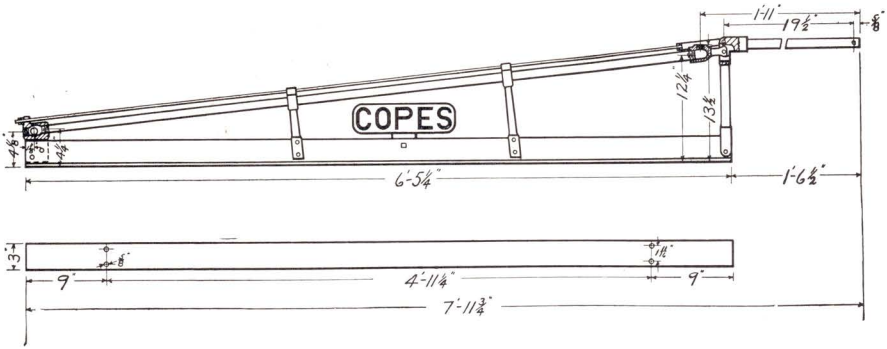


Fig. 14— COPES Thermostat

Installation of Thermostat

Thermostat Support Must Be Rigid.

The Expansion of the Tube Must Act to Open the Valve.

Thermostat Steam Connection Should Be as Short as Possible.

The thermostat should be placed so that the center of the *Tube* will be 1 inch below the normal water level, and with the base set level, the tube will have an 8-inch slope (see Fig. 27). On vertical water tube boilers, a greater slope than this is desirable and on horizontal return tubular boilers, a less slope may be used. The thermostat should set so that the *strut* connecting the thermostat lever and the valve lever will be *perfectly vertical.*

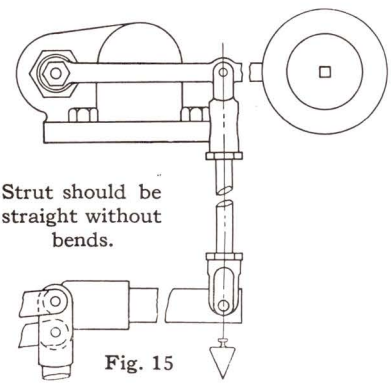


Fig. 15

With these points in mind, fasten heavy brackets to any convenient and solid support, preferably the steel work of the boiler or building. The brackets should be so located that future change in level of the thermostat may be obtained. The easiest way is to bolt them 2 inches away from the desired position of thermostat and place 2-inch nipples of ½-inch pipe, (D) Fig. 27, around the bolts, securing the the thermostat to the brackets. A light wooden frame, the size and shape of the thermostat, is sometimes useful in locating the supports.

Bolt the thermostat to these supports so that the hole in the lever (M) Fig. 27, is directly above or below the hole in the valve lever. A plumb line should pass through these holes. *The expansion of the Tube must act to open the valve.*

An excellent method is to mount the thermostat on a structural steel angle extending between the steel work of the boiler or building.

In any case the supports must be well made and rigid and in no case should the thermostat or support be fastened upon wooden platforms or other insecure foundations.

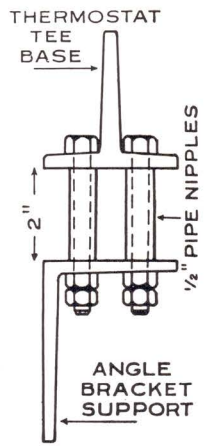


Fig. 16

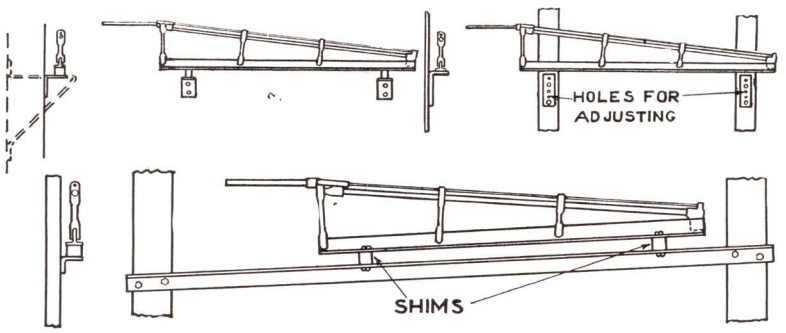


Fig. 17— Various methods of supporting thermostat

Steam Connection

A ¾-inch line, Fig. 27, should be run vertically up from the top end of the expansion tube and then drain to the boiler drum steam space. Cover with lagging if it is more than 12 feet long. Drain as much of this pipe toward the boiler as possible, with *not less than* 1 *inch drop per foot,* using bent pipe instead of fittings.

There must not be any pockets or traps in this line.

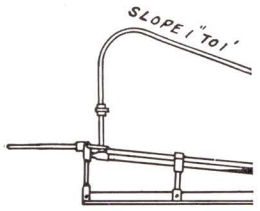


Fig. 18

This steam pipe (X) Fig. 27, should be connected directly to the steam space of the boiler at or near the top of this space. It may be made to the water column steam connection *if made within ten inches of the drum.* Do not connect to a steam header or other point which may have a pressure slightly lower than the boiler drum pressure.

Insert a *gate valve* in the steam line close to the boiler drum.

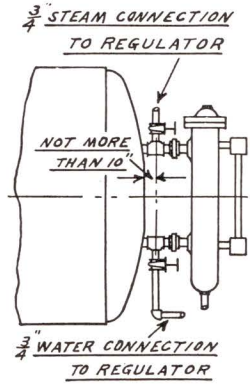


Fig. 19

Water Connection

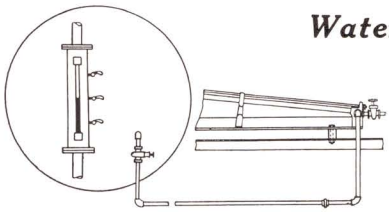


Fig. 20

Run a ¾-inch line (Y) Fig. 27, directly downward about 8″ or 10″ from the lower end of the expansion tube. Run a ¾-inch line directly down from the water space of the boiler. Connect these vertical pipes with a horizontal run of pipe. There should be a total of at least 8 feet

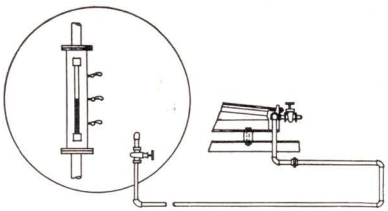


Fig. 21

of pipe and if necessary to secure this length, run a *horizontal* loop in this line. This connection should be made low enough so that steam cannot enter the line and should not be covered as it must radiate the heat in the water. *No part of this line should be more than three feet below the point of connection to the boiler.*

It is preferable to make the water connection to the drum on which the water column is placed, so that the level of water in the regulator will be the same as that indicated in the column.

It must be made to the same drum as the steam connection as there is often a slight difference in pressure between drums of the same boiler.

On some types of boilers the water column steam line is connected to one drum and the water column water line connected to another drum. In such cases it is preferable to connect the regulator in the same manner so that the water column is an indication of the level in the regulator. Do not make this connection directly to the water column, but if necessary, it can be made to the water column line *less than ten inches from the drum*, so as to eliminate interfering with the regulator action when the column is blown down.

Special connections for Badenhausen Boilers are shown by Fig. 33.

A gate valve should be placed in the water line close to the boiler. The casting (E) Fig. 27, at the lower end of the expansion tube has three openings. In the one not used, insert a nipple and valve for a blow-off. Plug the other unused opening.

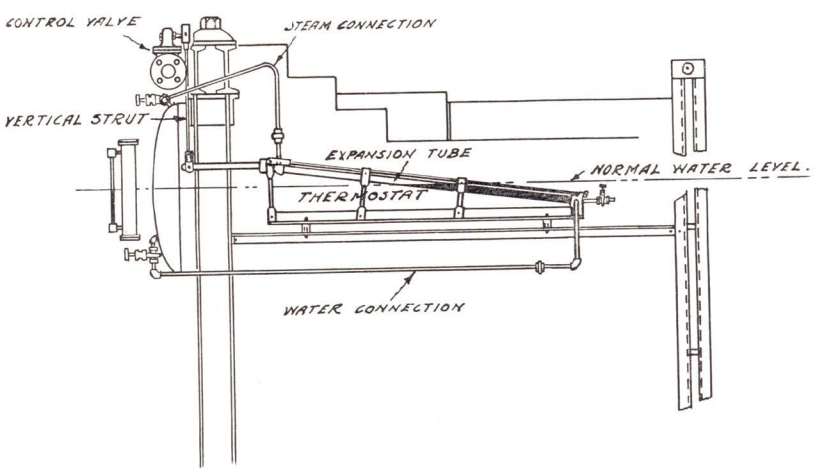


Fig. 22— Installation on B. & W. Boilers

Connection Between the Thermostat and Valve

Connect the two small clevises or strut connectors, which are furnished with each regulator, with a piece of $\frac{3}{8}$-inch pipe long enough to bring the thermostat lever and the valve lever horizontal when the clevises are pinned in the holes in the two levers. Since this connection depends upon local conditions the connecting pipe is not furnished with the regulator. *This connection must be vertical and contain no bends.* Do not bend the thermostat lever.

The best results can be secured only when all of the expansive force is transmitted to the valve. Side thrusts or springing between the levers should be prevented. Offset struts should not be used. *The thermostat supports and the control valve should be kept rigid.*

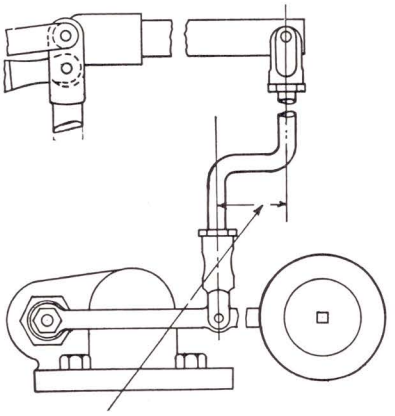


Fig. 23—Incorrect strut

Check Up Your Installation

Read this booklet through carefully and see that you have complied with all the installation details. Refer to Fig. 27, on pages 12 and 13, and see that you have followed each separate notation.

Slack off by several turns, the nuts on the tension rod at **E**, Fig. 27. With the gate valve in the steam line closed, open the valve in the water line so as to allow the regulator tube to fill with water. In about one minute close the water valve. Then open the steam valve and the regulator blow-off valve and blow down one minute. Close the blow-off valve and open the water valve. In about fifteen minutes the temperature in the regulator tube will be normal.

Now turn to page 16 and check over, for your installation, each question with the indicated answer.

Adjusting the Regulator

The Regulator should have been blown down as noted above. Bring the boiler load up to about normal. By means of the nuts on the rod at **E**, Fig. 27, adjust the regulator so that the valve lever is about horizontal. The hand feed valve should now be opened and the feed controlled by the COPES valve.

These adjustments should be made at normal load. In case the water input is too great, turn the adjusting nuts at the end of the thermostat so as to close the control valve slightly. If the feed is insufficient, turn the adjusting nuts so as to open the control valve slightly. In *doing this, bear in mind that only a slight turn of the nut will be necessary.*

After starting up a dead boiler, air is sometimes brought into the expansion tube with the steam. This collects on top of the water. Since this cannot condense, it has the same effect as a rise in

the water level and the regulator will carry the water lower in the boiler. This should be removed by blowing down the steam connection to the regulator.

Caution: Keep the Stuffing Box Packing soft and not too tight.

Operate the Control Valve by hand once or twice each day to keep it free from scale.

Do not blow down the regulator except when absolutely necessary.

Do not change the Regulator adjustment after the proper water level has been found.

Oil the Bearing Pins once a week.

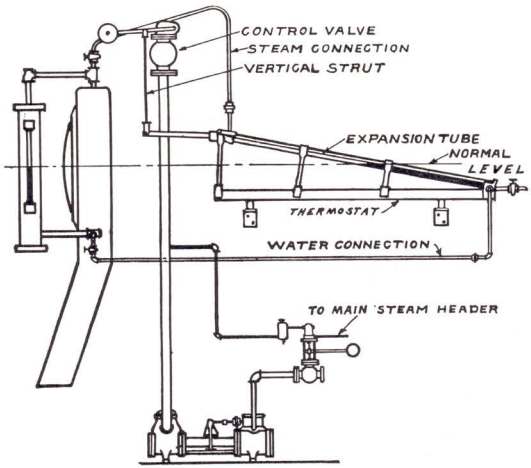


Fig. 24— One method of installing COPES Regulators on Edge Moor Boilers. This also shows the relation between the regulator and the pump.

Principle of Operation

The COPES Regulator depends for its operation upon the expansion and contraction of a metal tube as the water rises and falls in the tube. The water level in the tube should move exactly as it does in the water column.

At normal load the expansion tube should be half full of water and half full of steam. A sudden increase in load causes the steam pressure to drop and this in turn allows the water level in the boiler and in the expansion tube to rise. Due to radiation, the water in the tube has a much lower temperature than the steam, and a rise in water level, therefore, means a contraction of the tube. This in turn means a decrease in the control valve opening and a decrease in feed. A decrease in feed, together with a lowering of the boiling point of the boiler water caused by the decrease in pressure, means a very substantial increase in the rate of steaming just when that increase is desired.

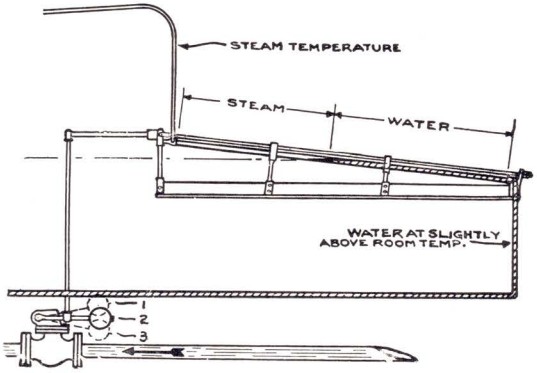


Fig. 25— COPES Regulator operation shown diagrammatically

The increased rate of steaming then quickly evaporates a considerable amount of water and the level in the tube falls below the center. This in turn causes more of the tube to expand and the control valve opening increases correspondingly.

If the load increases again the steam output is again increased and the water level drops still lower. This will continue only until the lowest desired water level has been reached. If the

overload remains constant, the regulator will automatically maintain the water level constant and at the point which insures maximum efficiency for that particular load. On decreasing loads, the regulator automatically raises the water level until the highest desired level has been reached.

A level for every load is what this type of COPES Regulator will produce. COPES Regulators are furnished in various other types to meet practically any operating condition that may be encountered. Information regarding the other types can be secured from the manufacturers.

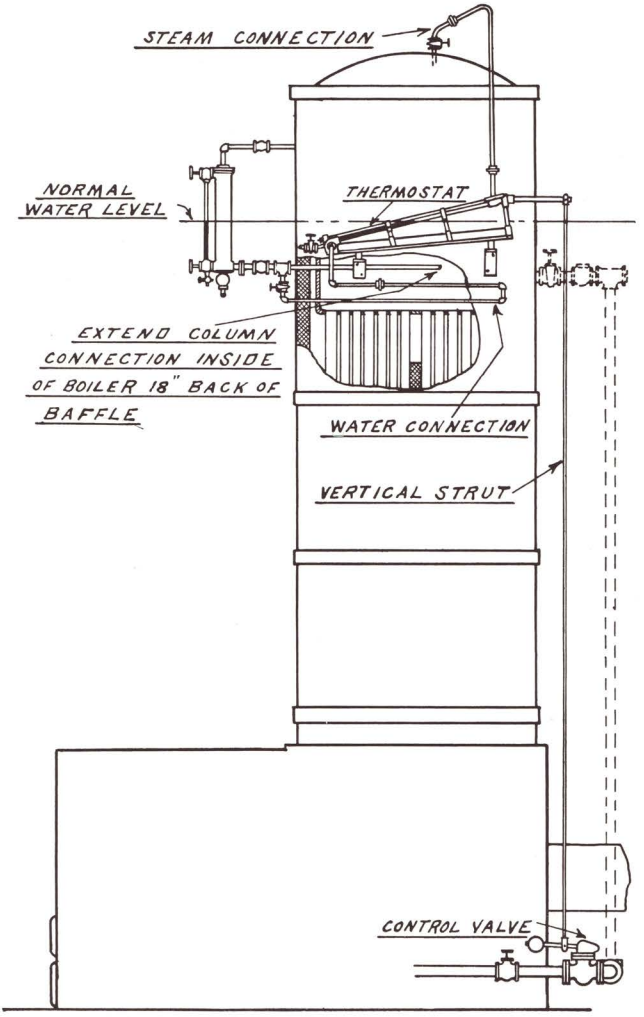


Fig. 26— One method of installing COPES Regulators on Wickes, Cahall, or other upright boilers.

NORTHERN EQUIPMENT CO., ERIE, PA.

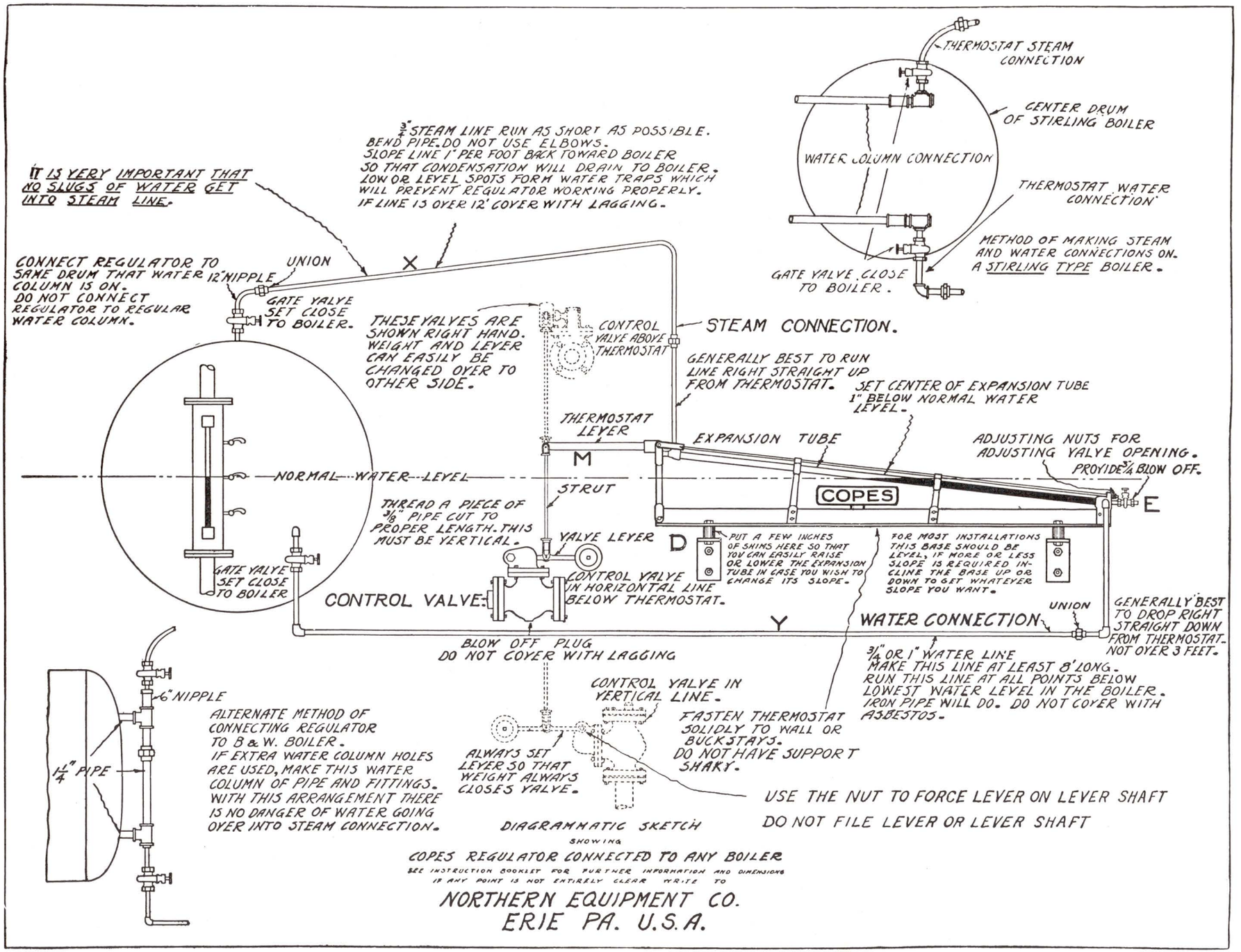
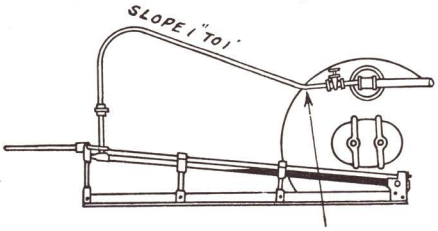

THERMOSTAT STEAM CONNECTION
CENTER DRUM OF STIRLING BOILER
WATER COLUMN CONNECTION
THERMOSTAT WATER CONNECTION
METHOD OF MAKING STEAM AND WATER CONNECTIONS ON A STIRLING TYPE BOILER.
GATE YALVE CLOSE TO BOILER.
3" STEAM LINE RUN AS SHORT AS POSSIBLE. BEND PIPE. DO NOT USE ELBOWS. SLOPE LINE 1" PER FOOT BACK TOWARD BOILER SO THAT CONDENSATION WILL DRAIN TO BOILER. LOW OR LEVEL SPOTS FORM WATER TRAPS WHICH WILL PREVENT REGULATOR WORKING PROPERLY. IF LINE IS OVER 12' COVER WITH LAGGING.
IT IS VERY IMPORTANT THAT NO SLUGS OF WATER GET INTO STEAM LINE.
CONNECT REGULATOR TO SAME DRUM THAT WATER COLUMN IS ON. DO NOT CONNECT REGULATOR TO REGULAR WATER COLUMN.
UNION
12" NIPPLE
GATE YALVE SET CLOSE TO BOILER.
X
THESE YALVES ARE SHOWN RIGHT HAND. WEIGHT AND LEVER CAN EASILY BE CHANGED OVER TO OTHER SIDE.
CONTROL YALVE ABOVE THERMOSTAT
STEAM CONNECTION.
GENERALLY BEST TO RUN LINE RIGHT STRAIGHT UP FROM THERMOSTAT.
SET CENTER OF EXPANSION TUBE 1" BELOW NORMAL WATER LEVEL.
THERMOSTAT LEVER
EXPANSION TUBE
ADJUSTING NUTS FOR ADJUSTING YALVE OPENING.
PROVIDE 3/4 BLOW OFF.
M
NORMAL WATER LEVEL
STRUT
COPES
E
THREAD A PIECE OF 3/8" PIPE CUT TO PROPER LENGTH. THIS MUST BE YERTICAL.
YALVE LEVER
D
PUT A FEW INCHES OF SHIMS HERE SO THAT YOU CAN EASILY RAISE OR LOWER THE EXPANSION TUBE IN CASE YOU WISH TO CHANGE ITS SLOPE.
FOR MOST INSTALLATIONS THIS BASE SHOULD BE LEVEL, IF MORE OR LESS SLOPE IS REQUIRED INCLINE THE BASE UP OR DOWN TO GET WHATEVER SLOPE YOU WANT.
GATE YALVE SET CLOSE TO BOILER
CONTROL YALVE IN HORIZONTAL LINE BELOW THERMOSTAT.
CONTROL VALVE:
UNION
GENERALLY BEST TO DROP RIGHT STRAIGHT DOWN FROM THERMOSTAT. NOT OVER 3 FEET.
Y
WATER CONNECTION
BLOW OFF PLUG DO NOT COYER WITH LAGGING
3/4" OR 1" WATER LINE MAKE THIS LINE AT LEAST 8' LONG. RUN THIS LINE AT ALL POINTS BELOW LOWEST WATER LEVEL IN THE BOILER. IRON PIPE WILL DO. DO NOT COYER WITH ASBESTOS.
6" NIPPLE
1 1/4" PIPE
ALTERNATE METHOD OF CONNECTING REGULATOR TO B & W. BOILER. IF EXTRA WATER COLUMN HOLES ARE USED, MAKE THIS WATER COLUMN OF PIPE AND FITTINGS. WITH THIS ARRANGEMENT THERE IS NO DANGER OF WATER GOING OVER INTO STEAM CONNECTION.
CONTROL YALVE IN YERTICAL LINE.
FASTEN THERMOSTAT SOLIDLY TO WALL OR BUCKSTAYS. DO NOT HAVE SUPPORT SHAKY.
ALWAYS SET LEVER SO THAT WEIGHT ALWAYS CLOSES YALVE.
USE THE NUT TO FORCE LEVER ON LEVER SHAFT
DO NOT FILE LEVER OR LEVER SHAFT
DIAGRAMMATIC SKETCH
SHOWING
COPES REGULATOR CONNECTED TO ANY BOILER
SEE INSTRUCTION BOOKLET FOR FURTHER INFORMATION AND DIMENSIONS
IF ANY POINT IS NOT ENTIRELY CLEAR WRITE TO
NORTHERN EQUIPMENT CO.
ERIE PA. U.S.A.

Fig. 27

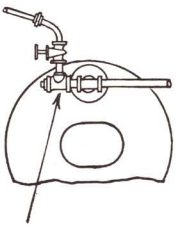
Securing Best Results

If the water level variation appears too great or if the water meter charts are not perfectly smooth, bear in mind that the COPES Regulator maintains a definite relation between steam output and water input so that a variation in input must accompany a variable output. Also bear in mind that the plant load may be constant, whereas the individual boiler loads may fluctuate widely. **The best Water Meter Charts can be secured only when all of the boilers are equipped with the COPES Continuous Feed Stablized Water Level Type of Regulator.** Hand fed or mechanical feed with floats, displacement bodies, springs or diaphragms on some of the boilers produces intermittent feed and ragged charts.



Incorrect

Fig. 28— Steam line sagged, causing water pocket and trap.



Correct

Fig. 29—Piping changed and trap removed.

If the water level drops too low and then rises too high without corresponding load changes, look for a syphon trap in the steam line. The line may be too long, it may contain a globe valve, it may be too small in diameter, or it may have sagged so as to cause a pocket. Remove the cause and improve the operation of the regulator.

If it is desired to raise or lower the normal water level, simply turn the adjusting nuts on the Thermostat at E, Fig. 27. This can be done in a few seconds without cutting the Regulator out of service.

In order to reduce the condensation and in that way keep the water in the tube at a lower temperature, it is advantageous to have the water level slightly above the center of the tube on average loads, rather than below the center. If the level in the tube, which can be located by squirting water along the tube, is ordinarily near the bottom, the thermostat should be lowered so as to raise the water level slightly above the center of the tube.

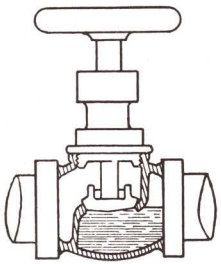


Fig. 30—Water pocket and Trap in Globe Valve

The best results can be secured only when all of the expansive force is transmitted to the valve.

Side thrusts or springing between the levers should be prevented. Offset struts should not be used. **The Thermostat supports and the control valve should be kept rigid.**

Since COPES valves are balanced piston valves there will be a slight leakage. This is not enough to change the water level materially unless the boiler is to be banked for some time.

Temperature changes either inside or outside the boiler room have no effect on COPES Regulators— they can be used out-doors if necessary. Ordinary boiler pressure changes do not affect the proper operation of the regulator, but in those cases where a very great change in steam pressure is made, the regulator should be readjusted as explained on page 9.

The regulation of feed water whether by hand or by any type of regulator can be greatly improved by the use of a pump governor of proper design. The governor should be of the fixed excess pressure type— not the constant pressure type. To insure a certain excess between steam pressure and pump discharge pressure and to insure reliability of operation a governor with a weighted lever is to be preferred to the spring type.

A constant pressure drop across the control valve should be maintained at all times. This is secured by using a reliable fixed excess pressure pump governor and having the feed lines of ample size.

With modern flash type boilers and automatic stokers it is possible to very rapidly increase the steam delivered. The water input must vary correspondingly. If the feed water header is small, it is possible only to carry the water to the boiler by using a high water excess pressure and with it high velocities. This acts against good feed water regulation. The feed water header should be large so that a low excess water pressure may be carried.

In case you have any particular operating difficulties, please write the Northern Equipment Co., Erie, Pa., and give details.

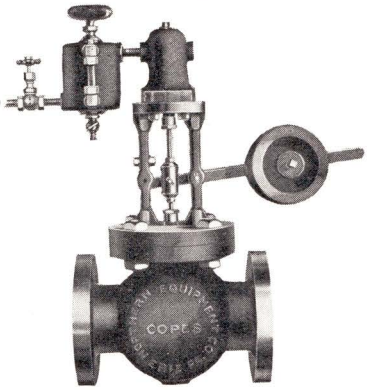


Fig. 31— Standard COPES Governor

The following check should be made to determine correct operation of COPES Boiler Feed Water Regulators

You should be able to answer each question as indicated:

Does the thermostat lever arm, when disconnected from the valve, move up when the water level in the gauge glass goes down? YES.

Does the lever go down when the water level rises? YES.

Are there any traps or level places in the steam connection to the thermostat? NO.

Is the valve in the steam connection to the thermostat a gate valve? YES.

Is the water connection to the thermostat at least 8 ft. long? YES.

Does this water connection to the thermostat drop below the point of entrance into the boiler and to the thermostat? YES.

Is bent pipe instead of pipe fittings used in the steam connection? YES.

Are the steam and water connections made to the same drum to which the water column is connected? YES.

Are there any leaks in the steam or water connections? NO.

Is the water level in the thermostat at the center of the expansion tube when the normal water level is carried in the gauge glass? (This may be determined by using a clean oil can to drop water along the expansion tube. The water will boil off instantaneously from the part of the tube containing steam). YES.

Have the steam and water connections been blown out separately? YES.

Is the thermostat rigidly supported to prevent lost motion in operating the valve? YES.

Is the vertical distance between upper and lower end of expansion tube eight inches? YES.

Is the strut between the thermostat and the valve lever vertical and free from bends? YES.

Does the weight act to close the control valve? YES.

Does the weight easily close the control valve when opened? YES.

Is a uniform excess feed water pressure maintained at all times over the steam pressure? YES.

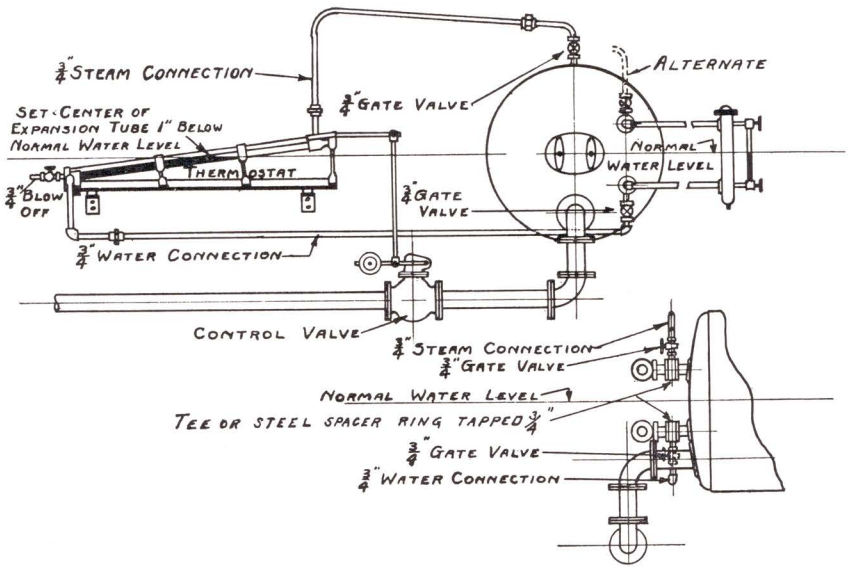


Fig. 32— Installation of COPES Regulator on B. & W. Cross Drum Type Boiler

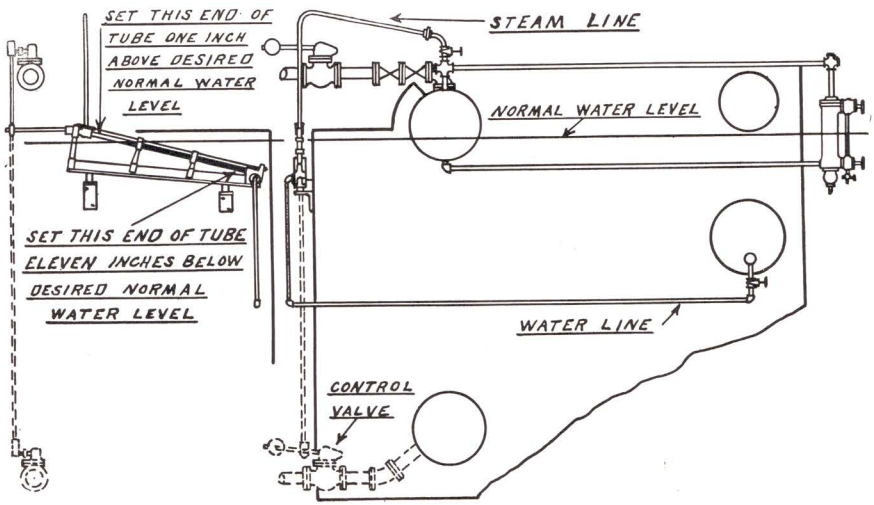

SET THIS END OF TUBE ONE INCH ABOVE DESIRED NORMAL WATER LEVEL
STEAM LINE
NORMAL WATER LEVEL
SET THIS END OF TUBE ELEVEN INCHES BELOW DESIRED NORMAL WATER LEVEL
WATER LINE
CONTROL VALVE

Fig. 33— Installation of COPES Regulator on Badenhausen Boiler.

Changing Valve Tops

Standing at the middle of the valve bonnet and facing the lever shaft, a right-hand valve has the weight lever on the right. Unless otherwise specified valves are shipped right hand.

To change a valve from one hand to the other, unscrew stuffing box (C), plug (A), and nut (B). Drive out lever shaft **E** and then insert it from the opposite side. Place A, B and C in their proper positions and the valve will be reversed.

Reference to the cuts on pages 2 and 3 will show the large number of positions that the tops can be made to assume. Simply select the one best suited to your conditions and in ordering regulators or valves designate by Fig. number how you wish the valves furnished. If changes are desired after the valves are received, they can be made very easily by following these directions.

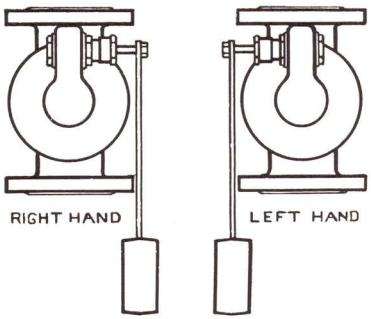


Fig. 34

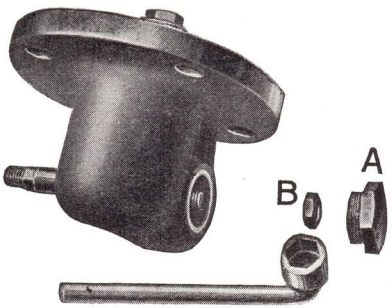


Fig. 35

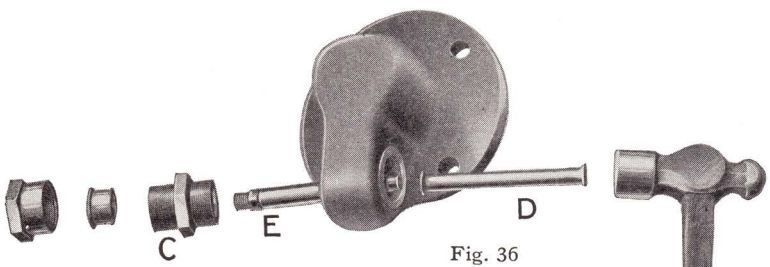


Fig. 36

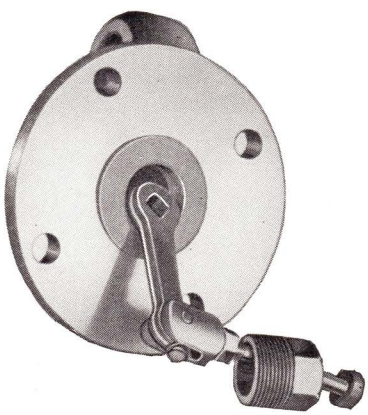


Fig. 37

Replacing Valve Fittings

Remove the bonnet but leave the valve in the line if you prefer. Remove the piston plunger. Secure a piece of flat steel wide enough to catch the lugs on the valve seat. Insert the flat steel against the top of the seat and strike several sharp blows with a hammer in different places around the seat. Unscrew the seat. The lower seat is removed in the same manner.

If the valve body tends to fill up with water, it can be drained through the blow-off plug.

Place a small quantity of white lead on the threads and screw the seats into place. Try the piston plunger in the hole. It should be a rather tight fit. Work it in with ground glass and oil until the plunger will of its own weight drop into place after the grinding compound is removed. Do not file the fittings or cut them down in a lathe.

Since the wear is equalized between the seats and the piston plunger, and since these parts are always made up in sets at the factory, the parts of a set should be kept together and both the seats and the piston plunger replaced at the same time.

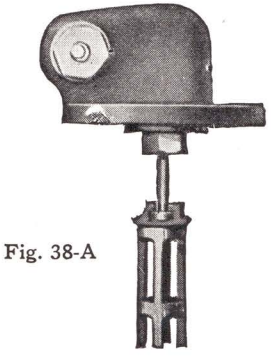
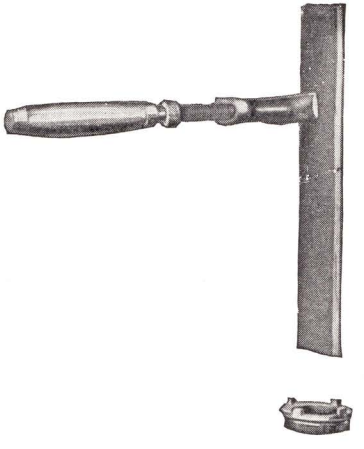


Fig. 38-A



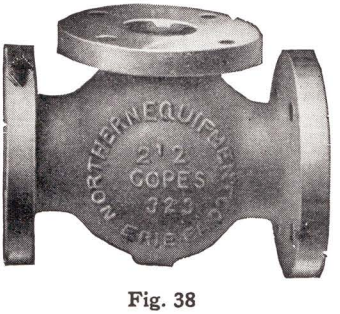


Fig. 38

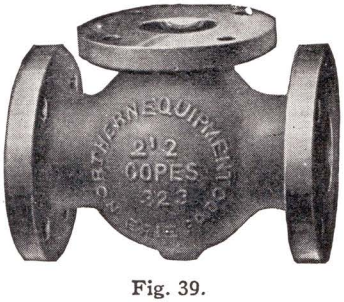
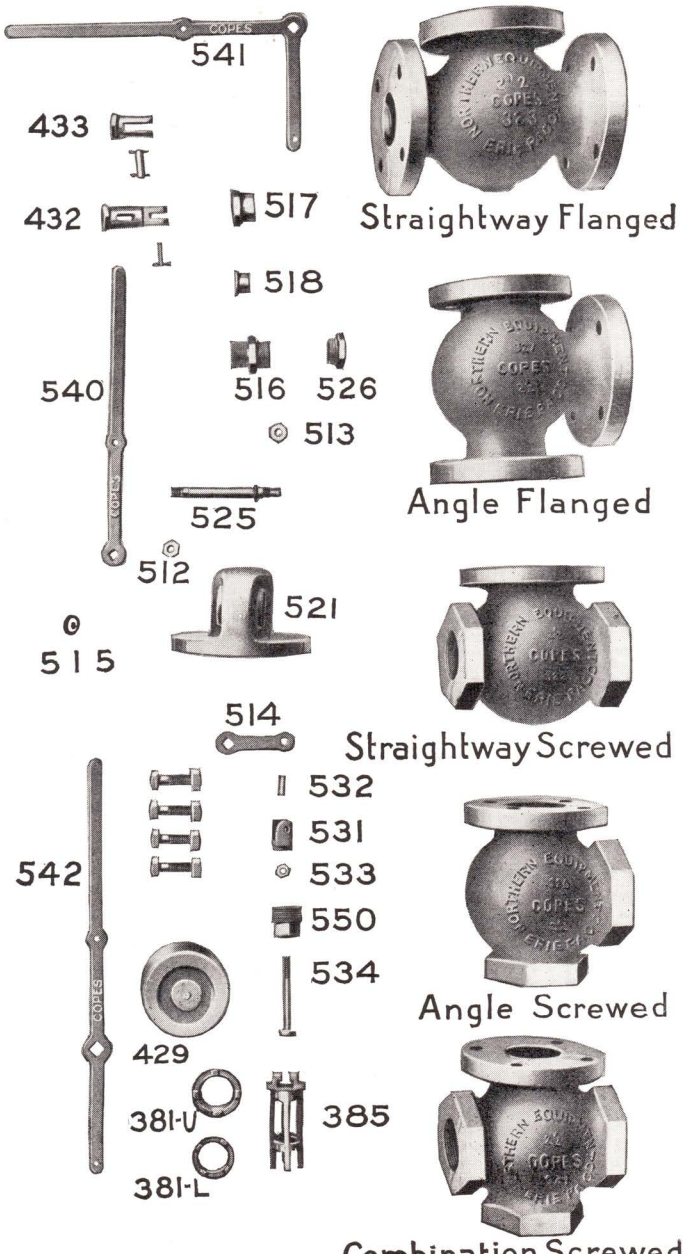


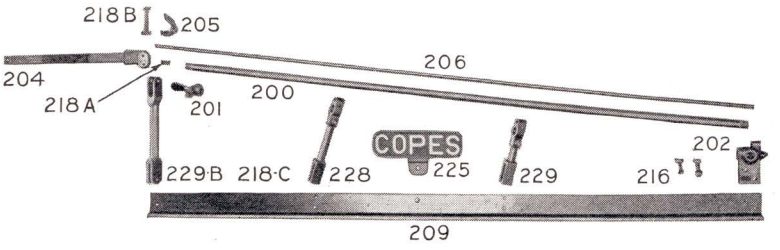
Fig. 39.

Valve Body Patterns



381U. Upper Seat
381L. Lower Seat
385. Piston Plunger
429. Weight
432. Valve strut connector or clevis
433. Thermostat strut connector or clevis
512. ½-inch nut
513. 9/16 inch bronze nut
514. Inside lever
515. 12 Packing rings.
516. Stuffing box
517. Stuffing box cap
518. Stuffing box gland
521. Bonnet
525. Lever shaft
526. Back bearing
531. Bronze connector
532. ⅜" x 1⅛" bronze connector pin.
533. ⅜" bronze nut
534. Bronze valve spindle
540. Outside lever
541. Outside lever right angle
542. Outside lever extended
550. Spindle guide
599. Complete Bonnet

In ordering spare parts specify: Number cast on the valve body, pattern as shown above, size of pipe, number and name of part wanted, and approximately when the original parts were received.



200. Expansion tube
201. Tube ell
202. Heel piece
204. Bellcrank lever
205. Tension fork
206. Tension rod
209. Tee base
216. Heel piece bolts
218A. 3/8" x 1 1/8" pin
218B. 3/8" x 3 3/8" pin
218C. 3/8" x 1 3/4" pin
225. Name plate
228. Long brace
229. Short brace
229B. Front brace

In ordering spare parts specify the name and part number and approximately when the original machine was received.

Special Service Conditions

If during certain periods the boilers are to operate at subnormal loads or if due to its continuous feed feature, the COPES Regulator Valve feeds more water than may be required at light loads, a Compound Port COPES control valve should be used. This depends upon the *size of the feed valve, excess pressure at the valve, ordinary load, and maximum load to be carried.* If you will submit that data to the Northern Equipment Co., Erie, Pa., with your order, you will receive valves with area designed to give the flow characteristics for your specific requirements.

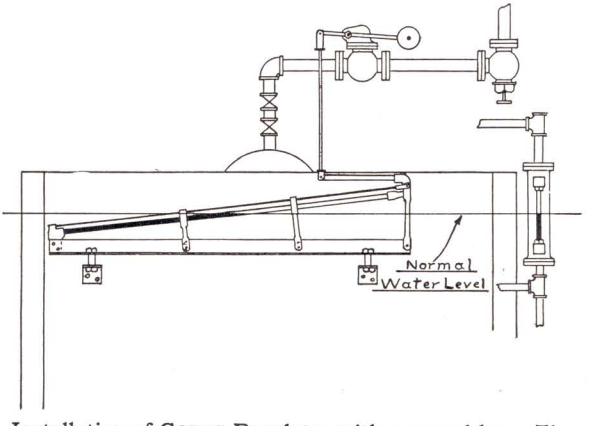


Fig. 40—Installation of COPES Regulator with reserved lever Thermostat.

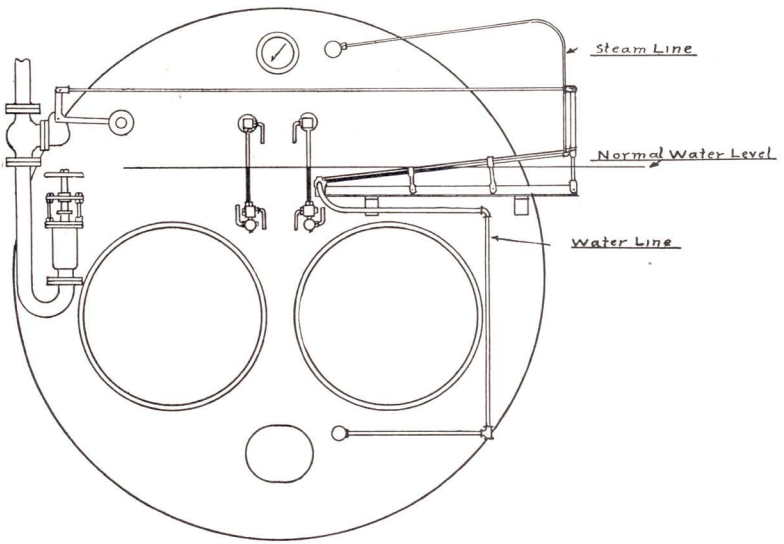


Fig. 41— One method of installing COPES Regulators on Lancashire Boilers. This also shows the vertical lever type of Thermostat

Unless otherwise specified, COPES Regulators are furnished with a thermostat and lever as shown by Fig. 27. For special conditions small size thermostats and special levers as shown by Fig. 40, 41 and 42 are furnished. This is dependent upon your conditions and should be taken up with the factory or the nearest district representative.

COPES valves, unless otherwise specified are furnished with hard bronze fittings. Where severe operating conditions are encountered, or where severe wire-drawing takes place, monel metal fittings are recommended.

In those cases where scale is so hard that it cannot be readily freed from the inner valve parts or ejected through the blow-off, the Type "C" COPES Control Valve should be used. Take this up with the factory.

To secure constant water level on constant loads, the thermostat slope should be at least 4 inches. On vertical water tube boilers the slope may be as high as 18 inches. The factory engineers will be glad to advise you on this point.

For use on large boilers where two separate feed lines are used, the COPES Duplex Method of Feed has been developed and patented. This is in use on a majority of the boilers of this kind and is a matter to be taken up with the nearest district representative or the factory.

A combined boiler and economizer regulator can be furnished in those cases where a low pressure economizer and two pumps or a split pump are to be used with a high pressure boiler.

Briefly, there is a COPES *Regulator for practically every set of operating conditions that may be encountered. They are used in practically every industry, on all types of boilers, in climates all over the world, and under all kinds of conditions. Therefore feel free to consult the nearest representative or the factory regarding any special condition that may arise.*

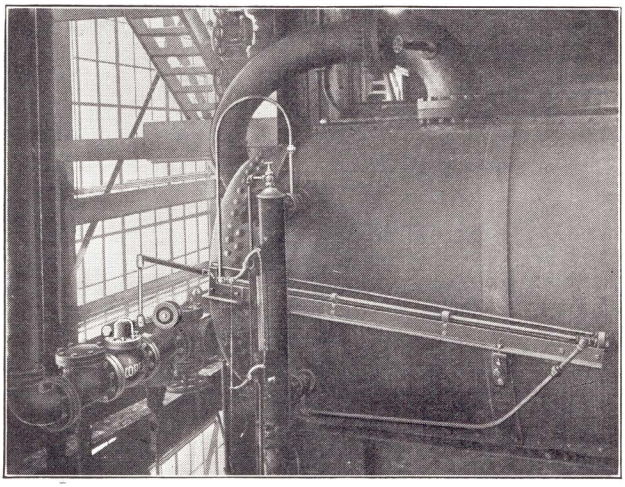


Fig. 42—Flat type COPES Thermostat

The Northern Equipment Company is exclusively engaged in the manufacture of power plant specialties— COPES Feed Water Regulators and COPES Governors. The policy has been to make these devices without the use of floats, displacement bodies, springs, diaphragms, needle or pilot valves or any other delicate and troublesome mechanism— in a word, simplicity and dependability with maximum efficiency have been the goals.

Consult us regarding any points that are not fully understood.

Write us regarding any improvements that you would make on COPES Devices, or regarding other power plant specialties which you believe might be of interest to us.

Preserve This Instruction Book for Future Reference

Additional copies of this or any other COPES literature will be gladly furnished on request

The COPES System of Boiler Feed Control is protected by the following patents:

Aug. 30, 1910	United States	Dec. 6, 1921	United States
Dec. 27, 1910	United States	Dec. 6, 1921	United States
Oct. 10, 1911	United States	Dec. 20, 1921	United States
Oct. 14, 1913	United States	Dec. 27, 1921	United States
Nov. 17, 1914	United States	Dec. 28, 1921	United States
July 27, 1915	United States	Jan. 6, 1922	Great Britain
Oct. 27, 1915	Great Britain	Jan. 24, 1922	Canada
Feb. 15, 1916	United States	Jan. 26, 1922	Great Britain
Nov. 7, 1916	United States	Jan. 29, 1922	Canada
Dec. 2, 1918	Great Britain	Feb. 14, 1922	Canada
Feb. 18, 1919	Canada	Feb. 21, 1922	Canada
Feb. 20, 1919	France	June 13, 1922	United States
Apr. 1, 1919	United States	Sept. 26, 1922	United States
July 22, 1919	France	Sept. 29, 1922	Germany
Dec. 2, 1919	Canada	Dec. 15, 1922	Austria
Apr. 8, 1920	Belgium	Dec. 19, 1922	United States
Apr. 20, 1920	Canada	Jan. 2, 1923	United States
May 18, 1920	United States	Jan. 19, 1923	Italy
June 2, 1920	Spain	Feb. 26, 1923	Great Britain
July 7, 1920	Germany	May 8, 1923	United States
Oct. 7, 1920	Great Britain	June 5, 1923	United States
Dec. 2, 1920	Canada	July 24, 1923	France
Dec. 14, 1920	Canada	July 26, 1923	Great Britain
Feb. 15, 1921	United States	Oct. 16, 1923	Germany
Feb. 24, 1921	Great Britain	Dec. 15, 1923	Czecho-Slovakia
Mar. 21, 1921	Great Britain	Jan. 29, 1924	Canada
Apr. 14, 1921	Great Britain	Jan. 30, 1924	Italy
Apr. 21, 1921	Great Britain	Jan. 30, 1924	Italy
July 12, 1921	United States	Jan. 31, 1924	Sweden
May 20, 1921	Great Britain	Feb. 11, 1924	Austria
Sept. 15, 1921	France	Feb. 14, 1924	Italy
Nov. 8, 1921	United States	Feb. 14, 1924	Italy
Nov. 8, 1921	United States	Mar. 10, 1924	Austria
Nov. 28, 1921	Great Britain		

Other Patents Pending

10M-D-12-24